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PROGRESS AND PROSPECTS OF TICK ERADICATION.

BY

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PROGRESS AND PROSPECTS OF TICK ERADICATION.

By COOPER CURTICE, D. V. S., M. D.,
Veterinary Inspector, Inspection Division.

The southern portion of the United States has long been afflicted by the presence of the cattle tick *Margaropus annulatus*. These ticks spread the infection of the disease known as Texas fever of cattle and often infest cattle so numerous as to stunt their growth and seriously affect their condition. Their presence necessitates a quarantine under which cattle from the infected regions may be shipped to other parts of the country only under certain restrictions and for immediate slaughter. The ticks also largely prevent the introduction and breeding of fine stock. The damage and losses caused by these parasites are enormous, being estimated at from \$40,000,000 to \$200,000,000 a year.

Systematic cooperative work by the Federal Government and the affected States for the eradication of these ticks has now been in progress nearly five years, and it is opportune to pause and look over the field to ascertain what has been accomplished, what obstacles have been encountered, and what may be done to assist in the further prosecution of the work.

THE BEGINNING OF TICK ERADICATION.

At a meeting of the commissioners of agriculture of the cotton-growing States held in Raleigh, N. C., in 1899, the Hon. S. L. Patterson, commissioner of agriculture of North Carolina, directed the writer to present the aim of that department in improving the cattle industry by tick eradication. From this beginning until 1906 12 counties in that State had been released from quarantine and 15 mountain counties had been permanently protected from the hitherto perennial threat of a Federal cattle quarantine. The commissioners' association and various allied organizations, influenced by the eradication work of North Carolina and the results obtained by Federal, State, and other investigators, together with the growing necessity of ameliorating the effects of the boll-weevil invasion, prevailed upon the United States Congress to make an appropriation in 1906 to empower the United States Secretary of Agriculture to inaugurate a plan of cooperation with the authorities of Southern States in the eradication of the cattle tick. The Federal appropriation for the fiscal year ended June 30, 1907, was \$82,500, and for 1908, \$150,000. Annually since then \$250,000, a sum sufficient to meet the advances of

those States interested in the work, has been appropriated. It is probable that succeeding Congresses will continue to meet the demand for future cooperation in the degree that States show real interest and actively engage in tick eradication.

In 1906 there were 15 States more or less infested with cattle ticks. These contained 929 counties that were quarantined to prevent the cattle from carrying the ticks into uninfected territory. While preparing to cooperate with the Southern States, the Chief of the Bureau of Animal Industry, to whom the Federal work had been assigned, ascertained that but 7 States had laws which would enable the bureau to cooperate with them. Work was begun in these, viz: Virginia, North Carolina, Georgia, Kentucky, Tennessee, Oklahoma, and California. Since then other States have enacted laws and undertaken cooperation, notably South Carolina, Alabama, Mississippi, and Arkansas.

RESULTS OF FIVE YEARS' WORK.

The results of the cooperative work for the eradication of ticks from July 1, 1906, to April 1, 1911, are as follows:

In Virginia there still remain infected 6 counties and parts of 2 counties, while 24 have been released from quarantine.

In North Carolina 30 counties have been cleaned, out of 72 infected in 1906. There are 8 of its 42 infected counties now cooperating. Twelve infected and quarantined counties were released on account of being disinfected of ticks by State action between 1900 and 1906. Ticks have been cleaned from 42 counties in North Carolina.

In South Carolina 4 counties out of 42 infected in 1906 have been released. There are 8 others nearly clean.

In Georgia 3 out of 144 counties infected in 1906 have been released. Three mountain counties had previously been disinfected.

Kentucky has been completed. In 1906 there were 2 infected counties and small areas in 2 contiguous counties.

In Tennessee 26 counties and parts of 8 counties have been released, and 7 counties and parts of 5 counties remain in quarantine. Six counties are now cooperating.

Alabama has cooperated in 7 out of the 67 infected counties.

In Mississippi 3 counties and four-fifths of the area of 2 others have been released, out of 78 infected in 1908. There are 17 counties now cooperating.

In Arkansas 10 out of 75 counties have been released since 1907. Work is going on in 9 others.

Louisiana has cooperated in 2 out of its 60 counties. These 2 are nearly clean.

In Oklahoma 7 counties and parts of several others have been released. There were 59 originally infected.

In Texas 7 whole counties and parts of 5 other counties out of 190 infected counties have been released.

California has but $3\frac{1}{2}$ of the 15 originally infected counties remaining, and these are nearly completed.

Missouri has 4 counties or parts of counties under quarantine.

Florida is doing no work in tick eradication.

Summary: There have been freed of ticks and released from quarantine 127 counties and parts of 20 counties out of 929 originally infected; 90 are in varying degrees of disinfection. Over one-seventh of the counties have been cleaned, and over one-fifth of all the originally infected counties have been worked in. About one-tenth of the counties now infected are being worked in and are partially clean.

Counties have been adopted as the unit of area in the statement of results just presented, rather than square miles or numbers of head of cattle, for it is with the county authorities and areas that both State and Federal authorities are compelled to deal. The areas of counties vary widely in different States and in the same State, yet the unit is a convenient one and gives a better idea of progress than any estimate of cattle or square miles released. When cost is to be considered, both of the latter must also be taken into account to obtain a comprehensive view of the eradication.

The progress of tick eradication in various States since 1906, shown both by counties and by square miles, is given in the following table and also by the accompanying map (fig. 21). A comparison of the completed area (139,821 square miles) with the original area (741,515 square miles) shows that one-fifth of the mileage area has been completed. The vast size of the desert counties in southern California now released accounts for much of the difference between the one-seventh of the counties and one-fifth of all area as shown by square miles.

Progress of tick eradication.

State.	Counties infected Aug. 1, 1906.	Counties in- fected Apr. 1, 1911.		Counties re- leased up to Apr. 1, 1911.		Counties in which eradi- cation is in progress.	Square miles re- leased up to Apr. 1, 1911.	Square miles in- fected Apr. 1, 1911.
		Whole.	Parts.	Whole.	Parts.			
Alabama.....	67	67	0	0	0	7	0	51,540
Arkansas.....	75	65	0	10	0	9	7,220	45,825
California.....	15	3	1	11	1	3	67,977	11,947
Florida.....	47	47	0	0	0	0	0	54,240
Georgia.....	144	141	0	3	0	6	815	57,328
Kentucky.....	2	0	0	2	2	0	841	0
Louisiana.....	60	60	0	0	0	2	0	45,420
Mississippi.....	78	73	2	3	2	17	2,032	44,308
Missouri.....	4	4	0	0	0	4	0	1,595
North Carolina.....	72	42	0	30	0	8	13,993	23,372
Oklahoma.....	59	52	0	7	0	6	7,890	40,000
South Carolina.....	42	38	0	4	0	8	2,673	27,497
Tennessee.....	42	8	4	26	8	6	11,989	17,210
Texas.....	190	178	5	7	5	11	13,311	178,574
Virginia.....	32	6	2	24	2	3	11,080	2,838
Total.....	929	784	14	127	20	90	139,821	601,694

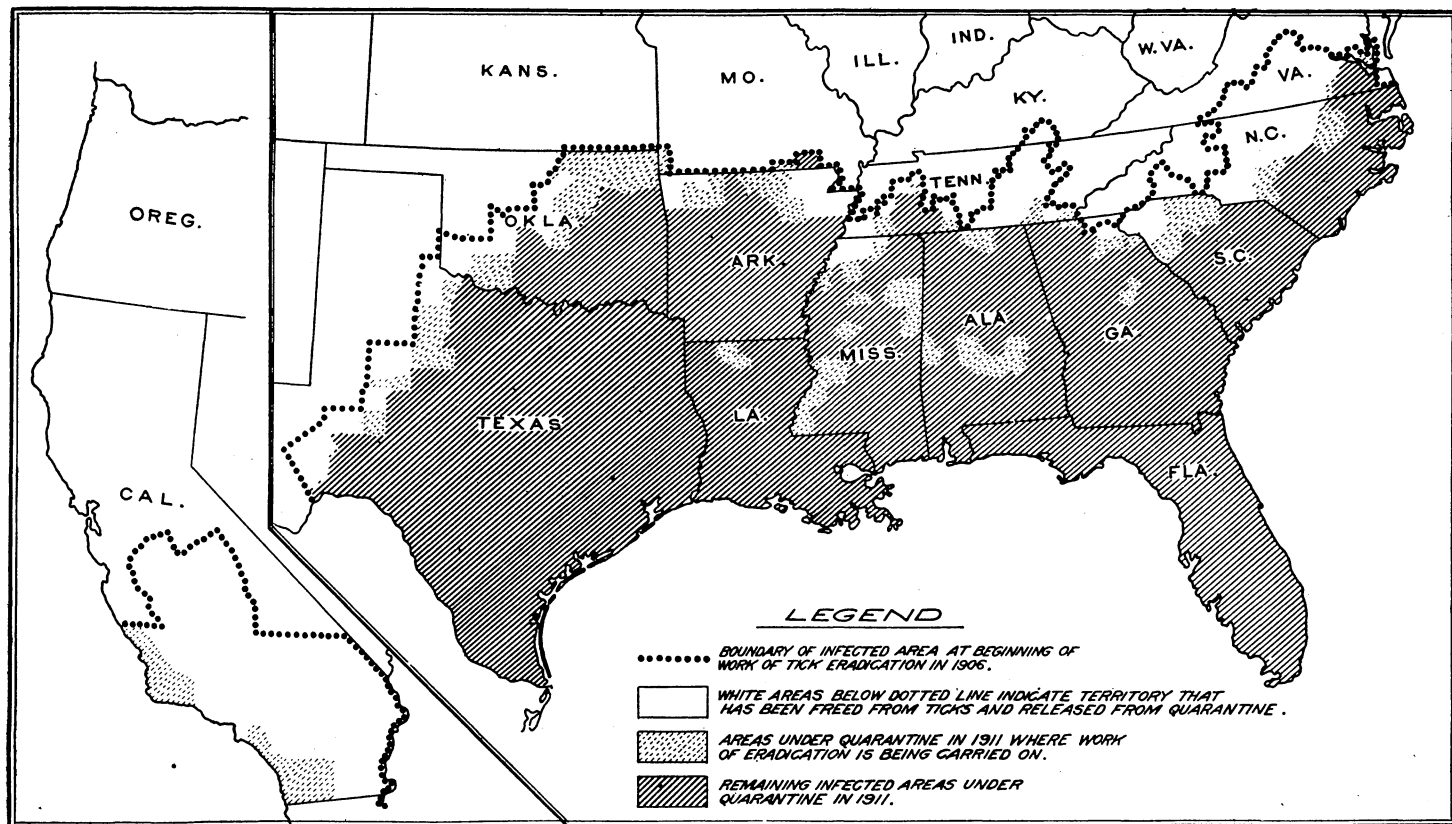


FIG. 21.—Map showing progress in eradicating cattle ticks.

SOME OBSTACLES TO PROGRESS.

Ignorance has been a great obstacle at all stages. While leaders in communities are informed concerning the benefits of eradicating the ticks, they are in the minority, and educational processes must still go on. The opposition is fortified with certain attendant drawbacks which are sometimes pointed out, and by a vast amount of misinformation which must be corrected. At the preliminary meeting of those interested in tick eradication held in Richmond, Va., in 1905, Dr. Tait Butler, then State veterinarian of North Carolina, took occasion to say to doubting members: "But it is being done; it has been done." If the doctors disagreed then, how much could have been expected? And how much can now be expected of him who lives isolated and reads not, or, reading, doubts? But it is upon this man—the farmer who has seen ticks all his life and knows no facts to point out their potency for harm—that States and counties are dependent for hastening the work.

Decidedly the hardest fifth of the work has been done, for where few farmers were well informed concerning tick eradication in 1906, thousands scattered throughout the tick belt now know that it is successful and are awaiting the day when their counties may begin the work. They are not yet in the majority, but their numbers receive yearly accessions. Where no county sought cooperation in 1906, many are waiting now. Where no county made any considerable appropriation in 1906, many now employ as many agents as the State furnishes, or more. Where the Bureau of Animal Industry furnished supervision and agents then, it furnishes but the former now. Where no money had been appropriated prior to 1906, the Federal Government now devotes \$250,000 annually, and States and counties more than \$150,000 more. These appropriations will likely increase rather than decrease, on account of awakened demand.

Rapid progress in tick eradication is dependent in large part upon the thorough control exercised over the cattle during summer, fall, winter, and spring, that they may not scatter ticks which may eventually infect other cattle or reinfect themselves through the seed ticks. The custom of turning cattle out to range through the unfenced swamps and roadsides prevents any tick eradication in many counties. The custom almost universally followed throughout the South of turning out cattle after the crops are gathered and letting them roam at large until the spring crops begin to grow has prevented success in many counties where tick eradication has been undertaken. Counties where this is permitted are known as "free-range" counties, while those having laws against cattle running at large are known as "stock-law" counties. When stock-law counties have been cleaned further effective work must wait until "stock law"

is adopted in the free-range counties. Cleaned cattle will always be more or less exposed to the ticks in the infected free-range regions.

Three-sevenths of the counties still infested, the majority of these being in the States bordering on and east of the Mississippi River, are free range. While counties have been successful in eradicating ticks under free-range conditions where cattle were cared for and kept under sufficient control summer and winter, there has been no success even in stock-law counties where the cattle have been turned out to range during the winter. Canebrakes, fodder, dried grasses, and spring grasses may make cheap forage, but they have certainly made cheap cattle and have been demoralizing to the southern cattle and farming industry by preventing forage crops, winter-cover crops, winter grains, and good breeding, and by encouraging thriftless management of cattle and stock. During the past year there have been stock-law counties cooperating in tick eradication, a majority of whose citizens have desired to stop work when it was pointed out that an agreement had been made with the county authorities that stock law should be observed all the year. The idea was not that tick eradication was harmful, but that winter pasturage was worth more than clean cattle and a market. The overcoming of this—the greatest obstacle to tick eradication, if not also to diversification of southern field products, especially hay and grain—needs the cooperation of every agricultural educational agency in the South.

Another class of obstacles lies in the methods of eradicating ticks. The surest methods, those depending on pasture rotation or feed-lot systems, fail because they are not used. Rotation is but exceptionally practiced. There are few fences other than the single pasture fence in the stock-law counties and the crop fence in the free range. These methods are practically and theoretically the best, but only those people conversant with the long educational campaign designed to bring about crop rotation and diversification of products can realize why they are not adopted. It is the free winter pasturage which costs the southern farmer so much.

There are left the tickicides, including oils, crude petroleum, and arsenical solution. They are applied by hand swabbing, by spraying, or in dipping vats. The methods are successful in the order named, the last being the best. In every county there are a number of doubting people who grudgingly make a show of disinfecting cattle. There are others who will not disinfect unless repeatedly urged. Such as these are careless about the material used and about the application. They fail of success for a long time. There is still another class who really try to do their best. They may be misguided in the kind of remedy used; they may purchase what agents direct, but the material furnished may prove wrong; either it is too weak in the strength advised, or if oil it will not emulsify in the hard waters

of the county. Too often the work is put off until large ticks have developed. The result is bad; no good is accomplished, and the season passes. The end is retarded.

More recently, however, arsenic solution has been willingly adopted by ever-growing numbers. It is sometimes applied by hand, but oftener by spray pumps or in the vat. In one county over 125 vats have been made; in other counties, from 25 upward. In some cases the counties pay for the cement and disinfectant used, and the people of the communities furnish gravel, sand, lumber, and labor. The farmers drive their cattle to these vats at stated times twice a month and dip them, the process often being supervised by the agent. The cattle being thoroughly immersed, all ticks are wet in the solution. The errors of greasing methods by hand and spray pumps are avoided. The arsenic solution, being cheaper and less injurious to the cattle, is preferred to the oil. The public vat with arsenic solution is succeeding easily where other methods have failed. Each State should adopt and use it wherever possible.

If States could devise a method by which disinfection would be compulsory, there might be no need of farm quarantine during the first year's work. If cattle were driven to the vat regularly eight or ten times, there would be little need for further dippings unless some animal had been accidentally left behind or overlooked. The quarantine of the few farms in the second year would not be so burdensome as the quarantine of the many which are now quarantined the first year. When the cost of constructing vats and of the disinfectants is paid by the county or State the time required for tick eradication is shortened and the cost of the work is lessened, thus making this by far the most economical method. If tickicides are to be employed, the community vat is the only cheap and efficient method. All others temporize.

Intercounty quarantines are unavoidable to a certain extent. Their restrictions can be greatly lessened by adopting large areas of disinfection. A prolonged maintenance of quarantine between clean and infected areas not only instructs the residents of the former in maintaining it but the latter in the necessity of tick eradication if they desire unrestricted movement of cattle. Such education is imperative before quarantines are lifted from clean areas. The efforts of the State should be directed toward engaging in cooperation as large blocks of counties as possible.

In the first year's work in many counties it has been difficult to get convictions of violators. They choose jury trials, and disagreements are the rule. Trials before justices of the peace now often succeed. It seems quite difficult for the average jurymen on these trials to base a decision on the evidence as presented. He is either for or against the "tick law."

The personnel of the officers engaged in tick eradication comprises United States veterinary inspectors, used as supervising inspectors, and State and county agents, who do the main work of inspection. The efficiency of each depends upon his capability, including tact and training. In 1906 all were new. Since then there have been continued changes. Exigencies of the service have required the shifting of Federal officers; completion of the work in counties has compelled the discontinuance of local agents. Even States have not built up a force of efficient workers because the pay allowed has been insufficient to maintain men away from home. The Federal force is continually improving because of the retention of men showing tact and adaptability and because of their acquired experience. The States should as time passes unite the best of the State and county agents into an active body for future work. The new agent takes some time to learn his duties and, having no previous experience, his first year is generally lost. Counties should call upon the State for a list of trained men and employ them as local agents. Much time is thereby saved. It is questionable, however, whether there should be any local agents. State agents should replace them, and a certain proportion should be paid from county funds. As the force is improved many of the obstacles now met in the field work will be removed.

The obstacles in the way of tick eradication may be summarized as follows:

1. Ignorance, which may be and is being removed through the instruction of agricultural workers and by the publication of information on tick eradication.
2. Failure of disinfectants through ignorance in using a faulty quality of material and carelessness in application. This condition is being improved by the use of arsenic solution in vats.
3. Failure to control cattle on account of free range, and lack of winter forage, fodder, and grain crops. This is the most serious obstacle and can be overcome only by persistent effort in demonstrating a better way and by enforcement of an all-the-year-round stock law.
4. Friction created by working in too small areas. Working in larger areas would relieve many local quarantine restrictions.
5. Failure of juries to convict violators on the evidence.
6. Untrained agents, due to frequent changes. The retention of the best State and county agents is advocated. State appropriations should be made with reference to finishing the work at an early date by proceeding at a regular annual rate.

SOME REASONS FOR TICK ERADICATION.

The effect of the invasion of a new territory by the cotton boll weevil is to turn the attention of the planters to producing diversified crops. Because they can no longer borrow money on the cotton crop to buy supplies they turn to raising crops to feed their animals

and families; then they increase their farm animals to consume the abundant forage they may raise. Thus cattle become a money crop and the planters are ready to pay more attention to them. Since successful cattle feeding and marketing depend upon the removal of the ticks, the work of tick eradication is taken up.

Money has been advanced to the planters in the South solely upon the future cotton crop. There has been no other crop to borrow on. Because everything had been bought at a high price, little money remained in the country when settling day came. The boll weevil thus has its effect upon the fertilizer bill. Commercial fertilizer can not be obtained on a crop so uncertain as cotton in the first few years of boll-weevil invasion. But fertility of the soil is one of the prime requisites for raising cotton and forcing its growth. Thus it happens that the raising of cattle is advised by agriculturists to produce the much-needed manure at the least cost. The cattle consume home-raised forage and restore nearly all in an available form to the soil. Fields used for pasturing or feeding cattle in the past have shown the effect of the manuring in the increased growth of cotton for 25 years after the cattle were removed.

The planters of southwestern Mississippi took up tick eradication because the boll weevil forced them to do this. This region has been practically the first to take it up without urging, and judging from this event it may be concluded that tick eradication will follow the advance of the boll weevil from westward to the east without further urging.

It is recognized that ticks are the principal if not the only cause of depression of the cattle industry in the South, as the necessary feed may be easily raised there when cattle are considered to be worth the trouble. Tick eradication will thus build up another southern industry and help to maintain cotton production through the manure, a by-product of cattle feeding. Further, the cottonseed meal now sent elsewhere for feeding cattle and making commercial fertilizer will be retained for the same purpose at home, and the loss now incurred by its shipment will thus be stopped.

When these facts are thoroughly recognized, and the southern planter is brought face to face with the boll weevil, tick eradication will receive the attention it merits.

PROSPECTS FOR THE FUTURE.

The fact that one-fifth of the infested area has been cleaned in the past five years does not afford grounds for estimating future progress. It is not reasonable to conclude that because the area cleaned was situated along the northern boundary it was easier to clean, and therefore that the remainder will require a proportionately longer time, or that because four-sevenths of the remaining counties are free-range territory this condition will indefinitely prolong the work. On

the one hand, better methods will hasten work, and, on the other, stock law may be adopted any year. It is true that tick eradication as now conducted waits on stock-law sentiment to prevail. Perhaps the demonstrated success of the work in one-seventh of the counties will prove an object lesson that will go far toward overcoming obstacles in the remaining area. There is hope that tick eradication, which has so far gone falteringly ahead, will soon advance with firmer tread toward its goal.

The centers of greatest activity will be for a year or two in the States of Oklahoma, Arkansas, and Mississippi, if the present situation is indicative of immediate future operations. The work in the States of Virginia, North Carolina, Tennessee, and California is either drawing to a close or coming to a standstill while waiting for backward counties to take up the work. Slow progress is indicated in South Carolina, Georgia, Alabama, Louisiana, and Texas; none in Florida. Unless more decisive action is taken in the free-range regions, the work in all States will halt at the free-range boundary.

If States should decide to take up an average of five stock-law counties yearly, the free-range limit would be reached as follows: North Carolina, 2 years; South Carolina, 6; Mississippi, 6; Alabama, 8; Oklahoma, 10; Georgia, 21; Texas, 35.

If it is assumed that free-range counties will come under stock law at the same rate, the States will be completed as follows: Virginia, 2 years; Tennessee, 3; South Carolina, 6; North Carolina, 9; Oklahoma, 10; Arkansas, 12; Louisiana, 12; Alabama, 13; Mississippi, 15; Florida, 10, plus the time it takes to start; Georgia, 29; Texas, 37. Any differences in the annual rate will hasten or delay the final date.

These figures have little value excepting as they convey an idea of the duration of the task and its completion under certain plans of action. Their study should stimulate authorities to plan for eradication to proceed at a certain definite rate. When it is considered that as many counties can work together as desire, it seems futile to delay the end beyond a reasonable time; for example, 10 years. It is, indeed, more profitable to take up areas containing 10 or more counties annually. At such rate the stock-law counties of all States except Georgia and Texas would be completed in 5 years. Even the State of Georgia need not be far behind, because 20 counties should be taken on account of the small size of each, and thus only half the time would be consumed. The infected area of Texas is about three times as large as that of any other State; therefore Texas should do three times as much work, or even more, for she has a greater cattle industry and more at stake. It is not impossible for the majority of Texas counties to be completed within 10 years. If this is done, however, the work must be prosecuted on a much larger scale than at present.

Most States have not as a whole desired tick eradication in the past. The comparatively meager appropriations have been made on account of only a few counties desiring to work. Just as the boll weevil stimulated Congress to make the first appropriation, and just as it caused Mississippi to take sudden interest recently, just so will it arouse enthusiasm in Arkansas, Alabama, Georgia, and Florida, as it reaches those States later on.

The cost of tick eradication to the Federal Government up to date has been less than \$1,000,000. Excluding over 40,000 square miles of semiarid lands released in California leaves 100,000 square miles disinfected at a cost to the Federal Government of less than \$10 per square mile. The cost to the States and counties has so far been much less, and there seems to be no prospect of its becoming more than that. The cost to the farmer is so quickly repaid by the well-being and improvement in cattle that all complaint of increase in taxes is quieted as eradication proceeds.

As one-seventh of the tick-infested territory has thus been cleaned at a cost to the Government of less than \$1,000,000, the other six-sevenths would, at the same rate, require about \$6,000,000. The estimated cost to any State may be attained by multiplying its infected mileage by \$10. It is probable that this cost will be maintained whether a State requires 5 or 20 years to complete disinfection.

Elsewhere, it has been stated that the minimum loss to the infected States was over \$40,000,000 annually. It is apparent, then, that disinfection of one-seventh of the counties is saving the country about \$5,000,000 annually, and that the tick-eradication service has already conserved to the country values far greater than the cost of the work. As time proceeds these conserved values will increase and accumulate, adding to the prosperity, not only of the South, but of the whole country.

The benefits of tick eradication are no longer a dream. In an area larger than two ordinary States formerly tick infested and pest ridden the cattle are now free of ticks and thriving as never before. They may be marketed without quarantine restrictions, and at better prices than cattle from the tick-infested area. Farmers are introducing improved stock and increasing their herds. Better arrangements are made for providing winter feed and otherwise caring for them. A new money crop has arisen from what was a neglected industry. And more than all this, the increased fertility of the soil brought about by a diversification, including forage crops, and the use of stable manures, has enabled the cotton farmer who has eradicated cattle ticks to prepare for the invasion of the boll weevil in such a manner as to feel its effects least.